Cost-effective surveillance and control strategies against the emerald ash borer threat in North America

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Cost-Effective Surveillance and Control Strategies against the Emerald Ash Borer Threat in North America

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The emerald ash borer (EAB), a pest of ash trees native to Asia, has been a threat to North America. More than 20 million ash trees have been killed since the beginning of the infestation, and thousands of them have been removed to slow down its impact. According to the USDA, EAB infestation represents a potential $60 billion loss to the U.S. economy. It is forecasted that the infestation has the potential to spread over all of North America by 2030, which can result in killing hundreds of millions of ash trees. Considering the fact that the Greater Kansas City area has more than 4.5 million ash trees and has been a confirmed EAB infestation area since 2012, further spread of the EAB may have a huge impact on the Kansas economy and environment. In this study, our objective is to maximize the net benefits of the ash trees on a given landscape by applying surveillance to the ash population, followed by treatment or removal of trees based on their infestation level. Specifically, we propose a new multistage stochastic programming model, which will allow us to consider all possible scenarios for surveillance, treatment, and removal decisions over a planning horizon to control the EAB invasion. Due to the model's complexity and state-of-the-art nature, we use a special-scenario reduction algorithm to reduce the size of the model. Results provide insights into surveillance and control policies, and provide an optimal strategy to minimize EAB infestation with a limited budget allocation.